

# A MONOPOLY IN ETHANOL PRODUCTION IN BRAZIL:

## The Cosan-Shell merger

By Carlos Vinicius Xavier, Fábio T. Pitta and Maria Luisa Mendonça





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## INTRODUCTION

In this publication, data and recent analyses will be presented on the expansion of sugar cane monoculture for ethanol production in Brazil, and in particular on the monopolisation in the sector due to mergers and the takeover of production plants by foreign companies. This study is focused specifically on the merger of the Brazilian company Cosan with the Dutch oil company Shell, which resulted in the formation of *Raízen*. Some of the central elements in our analysis concern the economical, social and environmental effects caused by the spread of the agricultural model based on monoculture and large land ownership.

In addition to the supposed environmental benefits deriving from the replacement of fossil fuels, the official line about the benefits of this growth includes the prospect of access to the external markets and energy security in times of crisis. With preferential access to loans and several forms of state subsidy, 45% of ethanol worldwide is produced in Brazil. Of all firms running the 435 production plants in Brazil, *Raízen*, the company formed in the merger between Cosan and Shell, is the largest producer.

## THE STRUCTURE OF JOINT VENTURE RAÍZEN

The Raízen corporation is the result of the partnership of Cosan with the Dutch oil company Royal Dutch Shell. The formation of the company was the major transaction of the Brazilian sugar energy sector thus far; one of its stated aims is to turn ethanol into an international commodity<sup>2</sup>. Products from the latest harvest were exported to The Netherlands, Finland, Switzerland, Japan, Argentina and Australia.

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2 Raízen (2011). Available in Portuguese on <<http://www.raizen.com.br/pdfs/apresentacao.pdf>>. Accessed: 9 June 2011.

## A monopoly in Ethanol Production in Brazil:

Raízen is one of the five largest companies in Brazil with an estimated market value of US\$ 20 billion. The company is responsible for an annual production of 2.2 billion litres of ethanol and 4 million tonnes of sugar. The company's growth strategy envisages an increase in production of 2.4 billion litres to give an annual total of 5 billion litres.

The composition of the joint venture includes the distribution network of Esso (in Brazil known under the name of Exxon), which merged with Cosan in 2008, with around 4,500 petrol stations, 550 convenience stores, and the operation of 53 fuel distribution terminals and in 54 airports. Within the transport and distribution business segments, Raízen will be responsible for an annual commercialisation of approximately 20 billion litres of fuel. For the formation of the joint venture, the assets of both parties were defined. According to sources from the company<sup>3</sup>, the assets on Cosan's part comprise the following:

- All its sugar and ethanol production units.
- All its cogeneration projects for electrical energy.
- The fuel distribution and retail segment of the Esso (Exxon) brand in Brazil.
- Ethanol logistics assets, including interest in the alcohol export terminal Terminal Exportador de Álcool de Santos S/A, in addition to shares in projects for the construction of ethanol pipelines.
- Net debt of approximately US\$2,524 million.
- Additional debt of R\$500 million from Brazil's government-owned development bank BNDES for investments related to the sugar and ethanol sector.
- Agricultural land worth US\$25 million.
- Possible contributions estimated at US\$300 million, to be received by Cosan from the joint venture over a period of approximately 5 years.

With regards to Shell's assets, the following were included:

- Its Brazilian fuel distribution and retail segment
- Its aviation fuel business.
- Shell's equity interest in *logen Energy Technology*<sup>4</sup>.

3 Cosan (2010). Available in Portuguese on <[http://www.cosan.com.br/cosan2009/web/arquivos/2010\\_08\\_25-JVA%20Cosan\\_pt.pdf](http://www.cosan.com.br/cosan2009/web/arquivos/2010_08_25-JVA%20Cosan_pt.pdf)>. Accessed: 09 June 2011.

4 *logen Energy Tecnology* is a biotech company specialised in the development of cellulosic ethanol. logen built and operates a demonstration plant to convert biomass into cellulosic ethanol using enzyme technology.

## The Cosan-Shell merger

- Its 16.3% stake in the share capital of *Codexis*<sup>5</sup>.
- A cash contribution of approximately US\$1,600 million over two years, of which US\$1,275 million during 2 years, the equivalent of a net sum of US\$1.625 million of payments to Shell for the licence of its brand for a period of 10 years, and approximately US\$325 million relating to associated contracts between Shell and its affiliated partners and the joint venture.

Among the assets Cosan keeps which will not form part of the deal are the following:

- Production and commercialisation of fuels of the Mobil brand in Brazil.
- Logistic business managed by Companhia Rumo Logística S.A.
- Business from the incorporation and development of land managed by Radar Propriedades Agrícolas S.A.
- Retail brands “Da Barra” and “União”.
- Sugar retail brands which may at Cosan’s discretion be used in the sugar retail segment operated by Cosan (as long as this is negotiated with and approved by Shell at the signing of the contract) or licensed to the joint venture based on its market value.
- The right to do business independently with regard to sugar commercialisation worldwide.
- Agricultural land, apart from the US\$25 in land to be contributed to the joint venture.

## **BACKGROUND ON COSAN**

Cosan’s history goes back to 1936, when the founding Ometto family built the first agro-industries unit, the Costa Pinto mill, in the municipality of Piracicaba in the state of Sao Paulo. This continues to be the corporation’s administrative headquarters until the present day. For some five decades, Cosan’s activities were concentrated in this sole agro-processing unit; only from the second half of the 1980s did the company adopt a policy of corporate and territorial expansion. This strategy is currently happening again and is aimed both at the incorporation of new production plants and mergers with different economic groups.

<sup>5</sup> Codexis is a company active in the development of biocatalysts. Codexis markets its biocatalysts for the pharmaceutical industry and is currently developing these components for use in the production of agro-fuels in partnership with Shell.

The first units to be incorporated by Cosan were the Santa Helena plant in Rio das Pedras, the São Francisco plant in Elias Fausto and the Ipaussu plant in Ipaussu, all in the state of São Paulo. This acquisition policy began in 1986 and gradually took shape as a process of territorial expansion, including the exploitation of owned and leased land. The start of this expansionist strategy was concurrent with the lifting of export restrictions on sugar from mills in the south-central region of Brazil. This was due to a change in the policy that previously granted exclusive access to foreign markets to the north-eastern region of Brazil<sup>6</sup> (LEAL, 2008).

This is the context which formed the basis for Cosan to become the largest company in the sugar energy sector in Brazil and one of the largest ones worldwide. In the 1990s the company initiates a research project into new types of sugar cane hybrids, mainly for the foreign market. This led to the production of VHP (Very High Polarization) sugar. The composition of VHP sugar allows it to be converted into different types of sugar for consumption by the client. This opened up a major avenue in the commodity market. The unconditional support of the Brazilian state must be stressed; the aim of this was to secure access for the sugar cane industry to the international market. An example is the concession received by Cosan from the state, in 1996, for a plot of land designated for the construction and exploitation of a terminal for the loading of sugar and grains in the port of Santos; this resulted in the subsidiary company of Cosan Portuária.

## **INTERNATIONAL CAPITAL PARTICIPATION IN COSAN**

This state concession of a port terminal to the Cosan Group is seen as a milestone for the stimulation of sugar exports specifically for the south-central region of Brazil. The start of activities in the port of Santos, in 1999, coincides with a deal between Cosan and the British sugar group Tate & Lyle. Through this partnership, the British company gains control over 10% of operations in the port terminal.

In the following decade Cosan involves itself in another infrastructure project to facilitate the sale of its products. This is the Alcohol Export Terminal of Santos (Teas: Terminal Exportador de Álcool de Santos SA), established in 2005, when ethanol exports were already intensifying. Teas is the result of the joint action of Cosan and other Brazilian and foreign companies, such as Crystalsev, Nova América, Plínio Nasari and Cargill. Cosan's participation in the enterprise amounts to 32% of the total capital<sup>7</sup>.

6 LEAL, H. M. Q. O grupo Cosan em questão: formação, expansão e reprodução do capital canavieiro no interior Paulista. In: SIMPÓSIO DE PÓS GRADUAÇÃO EM GEOGRAFIA DO ESTADO DE SÃO PAULO, 01., 2008, Rio Claro. Anais. Rio Claro: Programa de Pós-Graduação em Geografia – Unesp/ Rio Claro, 2008, p. 21.

7 Cosan (2011) Available on [http://www.cosan.com.br/cosan2009/web/conteudo\\_pti.asp?idioma=0&conta=45&tipo=35726](http://www.cosan.com.br/cosan2009/web/conteudo_pti.asp?idioma=0&conta=45&tipo=35726). Accessed: 20 June 2011.

In 2001 Cosan incorporates the plants of Gaza, in Andradina, and Univalem, in the municipality of Valparaíso, both in the state of Sao Paulo. To carry out these enterprises, Cosan could count with the participation of the French capital of corporations Tereos and Sucden; the result of this was the foundation of FBA (Franco Brasileira Açúcar e Álcool). From 2005, Grupo Cosan had exclusive control over the company's entire capital.

The expansion of Cosan led to the company's monopoly over sugar and ethanol production, as well as to its listing on the Sao Paulo stock market (Bovespa). From 2005, the Destivale plant in Araçatuba; Mundial, in Mirandópolis; Bonfim, in Guariba; Tamoio, in the municipality of Araraquara; and Bom Retiro, in the municipality of Capivari, all in the state of Sao Paulo, were incorporated.

Following the consolidation of activities in the state of Sao Paulo, a territorial expansion can be seen to begin towards the west-central region of the country. Starting in 2006, the focus has been on the construction of plants in the states of Mato Grosso do Sul and Goiás, in the municipalities of Caarapó and Jataí, respectively. Cosan expects to establish two more plants in Goiás, in the municipalities of Montividiu and Paraúna.

## **BUSINESS STRUCTURE OF THE COSAN GROUP**

Cosan, now in partnership with Shell, is the world's largest sugar cane producer, processing a total of 44.2 million tonnes in the harvest of 2008–2009. This resulted in the production of 3.2 million tonnes of sugar, of which 2.7 million for export in 2009. With respect to ethanol production, the company is the largest company in Brazil and among the top 5 worldwide; it is the world's largest producer of ethanol from sugar cane. Its harvest of the 2008-2009 season rendered an estimated 1.7 billion litres of ethanol, of which 456.4 million litres were exported. The corporation has 23 ethanol plants with a crushing capacity of around 62 million tonnes of sugar cane annually.

The other companies controlled by Cosan are:

**Rumo Logística:** Active in the multimodal logistics system, with a focus on the export of sugar and other solid bulk products. It performs the transport of cargo from the producing centres to the port facilities in Santos. The company's infrastructure consists of three business units:

**Terminais portuários de Santos (Santos port terminals):** These include facilities acquired through the merger, in 2008, of Cosan Portuária's sugar terminals, installed as a result of a concession by the state in 1996, with Teaçú Armazéns Gerais. The infrastructure can handle an annual shipping capacity of 10 million tonnes of sugar and other solid bulk products, in addition to a static storage capacity of 380,000 tonnes of bulk sugar and 55,000 tonnes of bagged sugar<sup>8</sup>.

8 Rumo Logística (2011). Available on: < <http://www.rumologistica.com.br/>>. Accessed: 23 June 2011.

**Ayrosa Galvão Terminal:** transfer terminal situated in the city of Jaú in the state of Sao Paulo, with installations with a loading capacity of 99 wagons per day. It is considered an important point for the reception of cargo arriving from the mills by truck, to continue by train to the port of Santos.

**Multimodal Logisport Terminal:** better known under its acronym CNAGA (Companhia Nacional de Armazéns Gerais Alfandegários), its installations are for 51% controlled by Rumo Logística. It is situated in the city of Sumaré in the state of Sao Paulo and is regarded by the sugar-alcohol sector as an important link between the sugar cane alcohol agro-industry of the state of Sao Paulo and the port of Santos. The terminal is accessible to all railway lines in Sao Paulo state and is next to some of the main highways, such as the Anhanguera, Bandeirantes and Dom Pedro roads. It has a storage capacity of 400,000 tonnes of sugar and the potential to load up to 120 wagons of 90 tonnes per day.

One of the goals Rumo Logística has set itself is the export of 10 million tonnes of sugar by 2014. The company has acquired 729 wagons and 50 locomotives to make this possible. In this process, labour time can possibly be reduced by up to 97%. According to the company, older wagons take around 90 minutes to unload, while the recently acquired wagons can perform this operation in as little as two minutes.

**Radar Propriedades Agrícolas:** this is a subsidiary company Cosan set up in 2008 which focuses on the rural real estate market. The aim of the company is to acquire agricultural real estate, particularly properties whose value Cosan reckons will increase. In this way land is purchased and later leased out to large agricultural producers or used for production by the company itself. This kind of exercise has been causing widespread speculation and rise in land prices in Brazil.

Because the production model Cosan uses is based on monoculture, extensive agriculture is inevitable; therefore, the company's monopolistic strategy depends on the control of large areas of farm land. This model makes the role of subsidiary company Radar in the land market even more important. In addition to sugar cane properties, Radar also owns land for the cultivation of soybean, cotton, maize and eucalyptus. Since it was founded, Radar has transferred US\$ 400 million in the land market and manages around 70,000 hectares.

**Cosan Alimentos:** the food branch of Cosan is the largest company in Brazil's sugar retail market. It dates from 2002, when the Barra Bonita plant in Sao Paulo and the Da Barra brand were incorporated. In 2009 Cosan Alimentos extends its portfolio with União, another brand, in addition to regional brands Dolce, Neve and Duçula. The company currently operates in industrial sites in Sertãozinho (Sao Paulo state), Piedade (Rio de Janeiro state) and Araquari (Santa Catarina state), as well as from filling rooms in Tarumã and Barra Bonita (both Sao Paulo state).

**Cosan Combustíveis e Lubrificantes:** Cosan's fuel and lubricant branch originates in 2008 with the acquisition of Esso Brasileira de Petróleo through the North American oil company Exxon Mobil. With this deal, Cosan took over the distribution assets for automotive vehicles and the Esso's production and distribution business for lubricants and aviation fuel in Brazil, including the licenses to use the Esso and Mobil brands. This transaction made Cosan the first completely integrated company in the sugar-energy sector in Brazil, controlling every step from the production of monoculture-grown sugar cane, via the industrial distillation of the ethanol, to the fuel distribution at petrol stations.

## THE CREDIT CRUNCH AND THE CONCENTRATION OF CAPITAL

One of the effects of the financial crisis of 2008 was an increasing concentration of capital in the production of ethanol. The possibility for national companies of rolling over their debt, as was done in the past, was negatively affected by the credit shortage during the crisis, which encouraged a process in which Brazilian plants were taken over by or merged with foreign groups. It is within this context that Shell has entered the sector by setting up a joint venture with the Cosan group.

These mergers of groups within the same sector and the resulting concentration were also relevant in the period, especially marked after the crisis of 2008, which saw a marked growth in the international production of flex-fuel cars. The Cosan group, at the time owning 24 plants in the south-central region of Brazil, was emblematic for this tendency.

Apart from the Dutch Shell, the following foreign companies are currently present in the Brazilian sugar alcohol sector, together owning more than 100 plants (in alphabetical order): Açúcar e Alcool Fundo de Investimento e Participações (formed of investment funds Carlyle/Riverstone, Global Foods /Goldman Sachs /Discovery Capital and DiMaio Ahmad), Abengoa (Spain), Adecoagro (of the Soros group, USA/Argentina), ADM (USA), Brazil Ethanol (USA), British Petroleum (United Kingdom), Bunge (USA), Cargill Inc (USA), Clean Energy (United Kingdom), Glencore (Switzerland), Infinity Bio-Energy (United Kingdom and others, owned by Bertin), Louis Dreyfus (France), Mitsubishi (Japan), Mitsui (Japan), Noble Group (China), Shree Renuka Sugars (India), Sojitz Corporation (Japan; owns 65% of ETH, an association with Odebrecht), Sucden (France), Kuok (China), Tereos (France) and Umoe (Norway).

The participation of foreign companies in the Brazilian sugar cane industry rose from 1% in 2000 to around 25% in 2010. A typical feature of the sector is the alliance between agribusiness sectors with companies in the oil, automotive, biotechnology, mineral, infrastructure and investment industries. In this setting, these sectors have no reason to oppose the oligarchy of the large land owners, who benefit if the plans for agricultural reform are put on hold or abandoned. It is in this context that the association of Shell with Cosan enters the scene. When announcing the deal, Shell's press release stated it hopes to create "a river of ethanol flowing from Brazilian plantations to forecourts around the world". (The Times, *Shell*

*deal promises river of green fuel in Brazil*, 02/02/2010. [http://business.timesonline.co.uk/tol/business/industry\\_sectors/natural\\_resources/article7011649.ece](http://business.timesonline.co.uk/tol/business/industry_sectors/natural_resources/article7011649.ece)

Other recent examples of mergers are:

- In 2009, British oil company BP announced it would start producing ethanol in Brazil, with an investment of US\$ 6 billion in the next ten years. BP will operate via Tropical Bioenergia, in association with the Maeda Group and Santelisa Vale in the state of Goiás, who have an area of 60,000 hectares at their disposal in the state for the production of sugar cane.

- In July 2009, Syngenta published its acquisition of land for the production of sugar cane billets in the Itápolis region (Sao Paulo state). The project includes the production of transgenic billets and the intention is to expand to other states, like Goiás, Minas Gerais, Paraná and Mato Grosso do Sul.

- Nine mergers took place at the beginning of 2010. In January, agricultural multinational Bunge announced it had bought four plants from the Moema Group, including the Itapagipe plant which had a 43.75% equity interest in the North American company Cargill. The transaction gave Bunge control over 89% of the group's sugar cane production, an estimated 15.4 million tonnes per year.

- In February 2010 the merger was announced of ETH Bioenergia, owned by the Odebrecht group, with Brenco (Companhia Brasileira de Energia Renovável), hoping to become Brazil's largest ethanol company, with an annual production capacity of 3 billion litres. Shareholders of Brenco include Vinod Khosla (founder of Sun Microsystems), James Wolfensohn (former World Bank President) and Henri Philippe Reichstul (former president of Brazilian oil company Petrobrás), besides participation from BNDES.

- Odebrecht works in partnership with the Japanese company Sojitz. The new group will control five plants: Alcídia, Conquista do Pontal (both in Sao Paulo state), Rio Claro (Goiás state), Eldorado and Santa Luzia (both in Mato Grosso do Sul). The conglomerate is also involved in the construction of an alcohol pipeline between Alto Taquari and the port of Santos and is planning to install plants in Africa. The company is hoping to attract R\$3.5 billion by 2012, of which at least 20% will come from BNDES, in addition to that bank's previous investment R\$ 2 billion in Brenco.

## **TOWARDS ETHANOL CERTIFICATION**

In their attempt to meet the international requirements for ethanol commercialisation, Brazilian producer organisations and associations have been trying to develop certifications to "demonstrate" their plants meet the social and environmental criteria, in a manner similar to the Bonsucro certification<sup>9</sup>, also known as the Better Sugar Cane Initiative.

<sup>9</sup> Source: BONSUCRO (Better Sugar Cane Initiative), information kit. Material available on <[http://www.bonsucro.com/assets/Bonsucro\\_membership%20-%20V4-1\\_ptbr\\_3.pdf](http://www.bonsucro.com/assets/Bonsucro_membership%20-%20V4-1_ptbr_3.pdf)>.

Bonsucro presents itself as an open and voluntary non-profit organisation whose goals lie in the definition of universal principles, criteria, indicators and guidelines solely for the production of sugar cane and its derivatives. Via this system, the idea is to establish a global, internationally recognised platform for the sugar energy sector while allowing for certain local conditions and circumstances typically present in the production of sugar cane.

The goal, according to the organisation, is to reduce, by measurable means, the impact of sugar cane production on the environment, while at the same time contributing to the social and economical benefits for sugar cane producers and all others involved in the supply chain in the sugar industry. Thus, they use the following working criteria:

- To abide by the law.
- To respect human and labour rights.
- To monitor input efficiency of the production and processing to increase the sustainability.
- Actively to monitor the biodiversity and ecosystems.
- Continuous improvement in key business areas.
- Utilisation of Bonsucro's spreadsheet to calculate greenhouse gas emissions of sugar cane production and processing.

## **RAÍZEN'S ROLE IN THE CERTIFICATION PROCESS**

The first company in Brazil to obtain the Bonsucro standard was Raízen, the joint venture of Shell and Cosan – a fact published by the company in June 2011. This certification was given for the production of 1.7 million tonnes of sugar cane, 130,000 tonnes of sugar and 63 million litres of ethanol. According to the corporation's Vice President of Sustainability and External Relations, Luiz Osório, the aim is within five years to get certification for the entire production of the company's 24 plants in Brazil.

In order to raise their ethanol export levels, other businesses in the sector are setting out strategies to meet Bonsucro's requirements, as well as other norms and regulations. Among these, Directive 2009/08/CE deserves a special mention; its rules state that producers shall not promote the reduction of land area used for food production, shall not use slave or child labour and will respect trade unions and collective negotiation procedures, among other things<sup>10</sup>.

<sup>10</sup> See the report *Anticipated Indirect Land Use Change Associated with Expanded Use of Biofuels and Bioliquids in the EU – An Analysis of the National Renewable Energy Action Plans* on [www.ieep.eu](http://www.ieep.eu)

However, certification is voluntary and does not guarantee the company will comply with the laws and regulations relating to environmental, social and labour issues. The cases described hereafter show that the expansion of sugar cane monoculture causes environmental losses, displacement of food crop culture and the infringement of labour rights. Even so, these companies use the so-called “social and environmental standards” to secure access to the international market. In a similar bid to improve their public image, several multinationals, primarily oil companies, are seeking to diversify their products.

## THE EXPANSION OF SUGAR CANE MONOCULTURE IN BRAZIL

Data from the Brazilian state-owned National Food Supply Company CONAB (Companhia Nacional de Abastecimento) reveal that the area planted with sugar cane jumped from 4.8 to 8.1 million hectares between 2000 and 2011; the amount of sugar cane processed rose from 257.6 million to 624.9 million tonnes and ethanol production increased from 11 billion to 27.668 billion litres. According to the Brazilian Ministry of Agriculture, Animal Husbandry and Supplies, sugar cane production increased by approximately 142% between the harvests of 2000-2001 and 2010-2011. With regard to the specific growth in sugar and ethanol production, the increase revolved around 138% and 161%, respectively, for the same period, as can be seen from the following table:

### Production in the sugar alcohol sector in Brazil

Harvest year	Sugar cane processing (tonnes)	Sugar production (tonnes)	Total ethanol production (1.000 litres)
2000/01	257,622,017	16,256,105	10,593,035
2001/02	293,050,543	19,218,011	11,536,034
2002/03	320,650,076	22,567,260	12,623,225
2003/04	359,315,559	24,925,793	14,808,705
2004/05	386,090,117	26,621,221	15,416,668
2005/06	387,441,876	25,905,723	15,946,994
2006/07	425,535,761	29,882,433	17,719,209
2007/08	495,723,279	31,026,170	22,526,824
2008/09	569,062,629	31,049,206	27,512,962
2009/10	604,513,600	34,636,900	25,866,061
2010/2011	624,991,000	38,675,500	27,699,554

Source: Brazilian Ministry of Agriculture, Animal Husbandry and Supplies. Acompanhamento de Safra – Cana-de-açúcar. Table by Xavier, C. V.

## THE EXTENSIVE NATURE OF SUGAR CANE PRODUCTION

Lately a trend towards a reduction in productivity can be seen, which is particularly significant in the regions considered to be the main sugar cane areas. In the latest harvest, the area of land used for sugar cane monoculture had increased by 9.2%, whereas the increase in productivity was just 2%. The state of Sao Paulo, where the majority of Brazilian sugar cane is grown, stands out in this respect as its productivity in the harvest of 2009-2010 signals an actual decrease, as can be seen from the following data:

### Sugar cane monoculture yield (kg/ha)

	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
north/ northeast	57,664	52,621	56,089	60,574	61,302	56,074	57,397
Sao Paulo	81,146	84,390	86,620	86,700	89,040	87,815	82,450
central- south	78,038	78,776	81,808	82,907	84,473	86,032	81,103
Brazil	73,897	73,868	77,038	78,969	80,965	81,585	77,798

Source: Brazilian Ministry of Agriculture, Animal Husbandry and Supplies.  
Acompanhamento de Safra – Cana-de-açúcar. Table by Xavier, C. V.

Sugar cane producers point to several cyclical aspects, mainly relating to climatic factors like the abundant rains in the harvest season of 2009-2010 or the prolonged dry season in 2010-2011. Although these factors can indeed have a negative effect, this is not sufficient to explain the full extent of the fall in productivity. The global economic downturn may also influence this development, considering the need for constant investment in raw materials to ensure yields continue to rise. Since the beginning of the millennium, these investments have risen significantly, mainly due to the release of funds by states, directed both at the production process itself and at research to optimise the production.

The recent drop in productivity has been accompanied by a constant increase in planted area, proving that this agricultural model is of an inherently extensive nature. In other words, the increase in processed sugar cane is the result of the expansion of the monoculture to “new” plots of land. This situation must be seen in the context of a crisis scenario, as the sector cannot maintain production levels without seizing more natural resources such as land and water. The recent drop in productivity therefore constitutes yet another impulse driving the expansion of sugar cane capital, in view of the need to increase the total sugar cane production to meet the demand of the mills, many of which are working below maximum processing capacity. The rise in production area can be seen in the following table:

**Sugar cane monoculture production area (1,000 ha)**

	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
north/ northeast	1,144	1,096	1,143	1,228	1,069	1,100	1,120
Sao Paulo	2,952	3,147	3,288	3,680	3,882	4,130	4,357
central-south	4,482	4,744	5,020	5,736	5,989	6,310	6,914
Brazil	5,625	5,840	6,163	6,964	7,085	7,410	8,034

Source: Brazilian Ministry of Agriculture, Animal Husbandry and Supplies.  
Acompanhamento de Safra – Cana-de-açúcar. Table by Xavier, C. V.

The majority of sugar cane plantations in Brazil are located in the country's south-central and north-eastern regions. These regions produce 89% and 11%, respectively. Within the south-central region, the state of Sao Paulo is the main producer with 54.23% of planted land, an estimated 4.3 million hectares. For the 2009-2010 harvest, CONAB estimates that the biggest expansion took place in the west-central region, mainly in the states of Mato Grosso do Sul (38.8%) and Goiás (50.1%)<sup>11</sup>.

These numbers show that the so called “new” expansion preferentially occurs in the Cerrado, Brazil's tropical savannah area, thanks to the presence of large river basins, an important element of the natural resources required in this agricultural model. New land is acquired through the substitution of food crops via the leasing of land. This procedure resulted in real estate speculation and a severe jump in the price of land, as well as a 30% increase in food prices. Another means of growth is to expand into environmental conservation areas, thus pushing the agricultural frontiers into the Cerrado, Pantanal and Amazon nature reserves.

Data from the Laboratory for the Processing of Images and Geoprocessing at the Federal University of Goiás indicate that the current rate of deforestation of the Cerrado may raise the biome destruction from 39% to 47% by 2050. This region is just as important as the Amazon region in terms of biodiversity: it is home to around 160 thousand plant and animal species, many of them endangered. The research shows furthermore that destruction of the Cerrado poses risks to the rainfall patterns and the water level in the rivers in the Pantanal and Amazon regions as these biomes are interconnected.<sup>12</sup>

<sup>11</sup> <http://www.conab.gov.br>

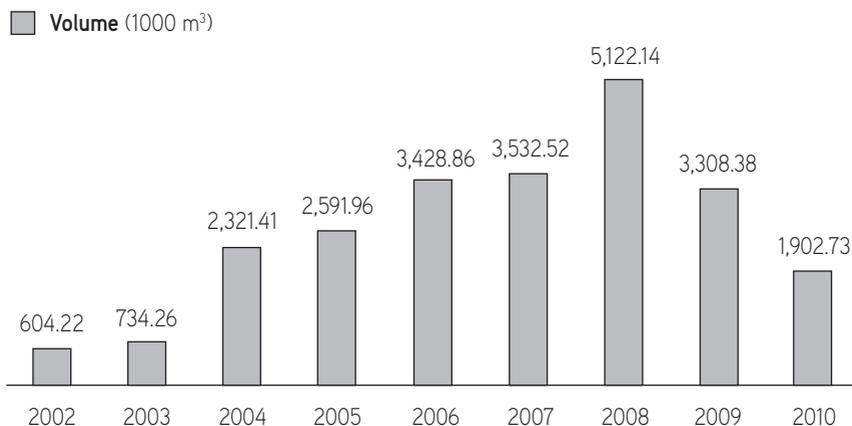
<sup>12</sup> Agência Brasil, *Estudo indica que desmatamento vai reduzir Cerrado à metade até 2050*, 19/06/2009.

## ACCESS TO THE INTERNATIONAL MARKET

The expansion of sugar cane monoculture received a boost during the presidency of Luiz Inácio Lula da Silva (2003-2010) via policies aiming to turn Brazilian ethanol into a commodity to be traded on future markets on the one hand, and on the other hand efforts to secure a series of ethanol export agreements, both bilateral and multilateral, mainly with countries in the European Union. However, public opinion came to look upon this movement towards business internationalisation with more distrust with the surfacing of countless cases of violation of environmental and labour laws, including the occupation of indigenous lands by sugar plantations (mainly in areas of expansion in the west-central region), the pressure exerted on the deforestation of the Amazon and the Cerrado, the displacement of food crops by sugar cane and the degrading conditions of the workers on sugar cane plantations, including hundreds of cases of slave workers.

But in spite of the social and environmental impact of the production, ethanol from the 2009-2010 harvest continued to be exported to several countries including European countries and the US. The Brazilian Ministry of Development, Industry and Trade has disclosed that Brazilian ethanol from the latest harvest was exported by more than 40 enterprises, from plants and cooperatives to international trade-oriented companies<sup>13</sup>. In terms of the number of suppliers, the largest share of Brazilian ethanol went to Europe, mainly to The Netherlands (23 suppliers), the United Kingdom (14 suppliers) and Switzerland (9 suppliers). Other important clients were the USA (14 suppliers), Japan (13 suppliers) and India (8 suppliers).

### Brazilian ethanol export



Source: Secretariat of Foreign Trade. Figure: Xavier, C. V.

<sup>13</sup> For these data see: [www.exportadoresbrasil.org.br](http://www.exportadoresbrasil.org.br)

The demand for Brazilian ethanol in these countries follows a policy boom, especially in Europe and the US, towards the substitution of fossil fuel consumption with what has been termed 'renewable' or 'clean' energy. It is just this kind of propaganda about the supposed environmental advantages of ethanol that guarantees an increasing international demand for the sector, which contributes to the constant growth in sugar cane monoculture and the impact generated by this agricultural model.

In the EU, the use of 'renewable' fuel was stimulated via Directive 2009/28/CE (May 2009), which requires each member state, by 2020, to obtain 20% of its total energy requirements and at least 10% of energy used in the transport sector from these sources. This is why the government and businesses in Brazil are lobbying heavily to secure access to this market.

The EU saw its consumption of these fuels jump from 5.9 million tonnes of oil equivalent in 2006 to 12.6 million in 2010 – an increase of 113.05%. The most important of these is biodiesel, the use of which rose from 4.1 million to 9.9 million tonnes, and bioethanol, going from 880, 000 to 2.5 million<sup>14</sup>. In the United States, the Environmental Protection Agency<sup>15</sup> estimates that in 2022 up to 80 billion of the 136 billion litres of biofuel likely to be needed will be coming from sources considered 'renewable'. This is three times the actual use in Brazil, which was around 25 billion litres in 2010. Last year, 1.5 million tonnes of ethanol was exported from Brazil, a reduction of 42.4% compared to the harvest of 2008-2009<sup>16</sup>. This meant that ethanol prices rose on the internal market and ethanol could no longer compete in price with petrol in the period between harvests.

## **PUBLIC FINANCING AND SUBSIDIES**

Historically, sugar cane plants have been dependent on various forms of state subsidy. During President Lula da Silva's government (2003-2011), the owners received R\$ 28.2 billion in loans from the Brazilian government-owned Development Bank BNDES. For example, for 2010 only this was R\$ 7.4 billion, used to finance different steps from sugar cane culture (R\$ 953 million) to sugar and ethanol production (R\$ 5.6 billion) and energy cogeneration (R\$ 665 million).

The total amount in loans is higher than that lent to other sectors that year, like the paper, cellulose and extractive industries (together R\$ 3.1 billion), the mechanical industry (R\$ 5.3 billion), the metal industry (R\$ 4.9 billion) or the textile and clothing industry (R\$ 2.1 billion)<sup>17</sup>.

14 *O Etanol Brasileiro no Mundo – Os impactos Sócio-Ambientais Causados por Usinas Exportadoras*. On: [http://www.reporterbrasil.org.br/documentos/Canafinal\\_2011.pdf](http://www.reporterbrasil.org.br/documentos/Canafinal_2011.pdf); May 2011.

15 See site [www.epa.gov](http://www.epa.gov) .

16 According to data from the Secretariat of Foreign Trade of the Ministry of Industry, Commerce and Tourism: [www.mdic.gov.br](http://www.mdic.gov.br)

17 See: [http://cptnacional.org.br/index.php?option=com\\_content&view=article&id=567:na-era-lula-usineiros-receberam-mais-de-r-28-bi-do-bndes&catid=13:geral&Itemid=54](http://cptnacional.org.br/index.php?option=com_content&view=article&id=567:na-era-lula-usineiros-receberam-mais-de-r-28-bi-do-bndes&catid=13:geral&Itemid=54)

During 2008, when the international financial crisis erupted, BNDES even supplied working capital to the sector's firms. These sums are also exorbitant looking at the money the industry received in subsidised loans, at negative real interest rates, over the entire duration of the Proálcool programme<sup>18</sup>, a total corresponding to approximately 8 billion dollars from 1975 to 1990<sup>19</sup>.

Several authors have highlighted the presence of subsidised loans to the sector, in the past and the present, including debt pardoning. Dr Pedro Ramos<sup>20</sup> of the Economics department of the University of Campinas (UNICAMP) stresses the fact that the compulsory addition of ethanol to petrol, even when ethanol prices go up, can also be seen as a form of subsidy. Other authors seek to emphasise that production subsidies are implicit in the ethanol sector.

A recent monography by Ogata<sup>21</sup> for instance, draws attention to the ongoing phenomenon of indirect and "concealed" ethanol subsidies in the form of lower rates of state VAT (ICMS) and federal fuel import and sales tax (CIDE) than for petrol; this gives the industry a competitive edge and guarantees its market share. In the state of Sao Paulo for instance, VAT for ethanol is 12%, compared to 25% for petrol (Ogata 2009: 40).

To finance these loans, the Brazilian government itself needs to borrow money as the amount collected in taxes is insufficient to cover all its needs. The subsidy consists of the basic tax difference between the interest rate paid over these debts by the government, the SELIC rate (12.25% per year) and the interest rate charged by BNDES (around 6%). In other words, by receiving loans with interest rates well below market rates, the sugar cane industry creates debts to be covered by the tax payer.

Dr Pedro Ramos calculates that loans received by the sector from BNDES, mainly for the mechanisation of sugar cane harvesting in the twenty-first century, racked up a total debt for the plants of R\$40 billion in 2009 (Ramos, 2011: 17). This is equivalent to two thirds of the loans BNDES granted to the whole of agricultural production in 2007. That means that the sector's production depends on subsidised loans, which allows us to distinguish different forms in which the government grants these subsidies. For example, throughout the Proálcool programme, interest rates on the loans were even below inflation levels, thus representing a direct subsidising.

18 Programa Nacional do Álcool, by the government of Ernesto Geisel (1974 – 1979).

19 TRIBUNAL DE CONTAS DA UNIÃO (TCU). *Proálcool: Relatório de Auditoria Operacional*. Brasília: TCU, 1990.

20 RAMOS, Pedro - *Financiamentos subsidiados e dívidas de usineiros no Brasil: uma história secular e ... atual*. Mimeo, edição do autor, 2011.

21 OGATA, Leandro Marcel. *O Setor Sucroalcooleiro no Brasil: Desenvolvimento, Modernização e Competitividade*. Mimeo, BSc Thesis for the Faculty of Economy and Management, University of Sao Paulo, 2009.

## LAND INCORPORATION FOR SUGAR CANE MONOCULTURE

Sugar cane production for Cosan-Shell takes place both on land owned by the company and on land owned by others. Currently, the use of external properties appears as the main trend, particularly in the regions where the most expansion takes place. A study about this trend shows that the recent boom in ethanol production is based on two types of territorial expansion: via the displacement of food crops or by the expansion of agricultural land into environmental conservation areas. Food crop displacement by sugar cane plantations can occur in three forms, namely via the use of land from suppliers, lessors or partners<sup>22</sup>.

The suppliers produce the sugar cane at their own expense and then sell it to the mills. This transaction can take place through an exclusive supply contract, drawn up beforehand with a specific mill, or separately, with any mill, if no previous contract exists. As for payment, in most of the country suppliers are paid according to the Consecana model<sup>23</sup>, in which the price of the cane is determined by the amount of Total Recoverable Sugar (TRS) in each tonne of cane.

This way, the amount stipulated to be paid to the suppliers depends on the quantity and quality of the raw material. This is one of the ways in which the mills manage to manipulate the product price, as the suppliers usually do not have access to the way these calculations are made. Another problem is the oscillation of sugar cane prices, which usually fall precisely in times of harvest and supply to the mills.

These suppliers are in their majority large land owners, present in various regions of Brazil where cane is grown. They are usually organised in associations such as AFOCAN, the association of sugar cane suppliers of Northeast Sao Paulo. This is just one of the associations with close relations with the Cosan Group and it is responsible for the supply of around 30% of total sugar cane processed by the Gaza unit in Andradina. In other regions where Cosan has mills, different supplier associations similarly guarantee the supply of sugar cane for processing. But it should be stressed that in addition to the associations, other individual producers, not united in associations, are also large suppliers to the mills.

A lessor is a land owner who rents out his land through a contract in which he agrees, for a determined or indefinite period, to grant the lessee the use of the property. Farmers leasing out their land practically use control over this land, as these contracts run over a long period

22 Confederação da Agricultura e Pecuária do Brasil. *Cana-de-açúcar: orientações para o setor canavieiro*. Confederação da Agricultura e Pecuária do Brasil; Serviço Nacional de Aprendizagem Rural. Brasília: CNA/SENAR, 2007. Available in Portuguese on: <[http://www.agencia.cnptia.embrapa.br/Repositorio/Cana-de-acucar\\_orientacoes\\_para\\_o\\_setor\\_canavieiro\\_000fipw96tk02wyiv80z4s4733kvhu6q.pdf](http://www.agencia.cnptia.embrapa.br/Repositorio/Cana-de-acucar_orientacoes_para_o_setor_canavieiro_000fipw96tk02wyiv80z4s4733kvhu6q.pdf)>.

23 Consecana is a council composed of representatives of rural sugar cane producers and industry representatives. Its aim is to establish and publish reference values for sugar cane commercialisation.

of time. Sugar cane monoculture makes it impossible to carry out any other farming activity, which leads to loss of fertility of the soil, environmental degradation, rural exodus and the displacement of food crops.

A partner lets the partner use his property with a share in the profits and losses of the activity. These contracts normally have a term of 6 or 7 harvests.

Partners are paid according to the Consecana model, using the average TRS of 121.96 kg TRS/tonne. However, the TRS varies according to the amount of sugar present in each harvest and its concentration per tonne changes for the different monoculture areas. Additionally, the value of the TRS itself is not stable, but varies depending on the value of sugar and ethanol on the internal and external market. This way, the partner risk receiving less than expected. Another risk factor for the partner is formed by the fact that the productivity of sugar cane fields tends to fall over time.

Cosan uses approximately equal amounts of sugar cane from own production and cane produced by external suppliers. The proportion varies between the different units, but the overall trend hovers around 50%. Cosan's recent expansion took place both through the purchase of agricultural property (via its subsidiary company Radar Propriedades Agrícolas) and through land use agreements in the form of lease contracts and / or partnerships.

Another characteristic feature of the Cosan-Shell group is the strategy of outsourcing its cane production. The firm has extended this system since the end of the 1990s, particularly for properties under a lease or partnership contract, where the phenomenon of "sublease" or "sub-partnership" can be observed. This way, Cosan seeks to escape responsibility for the production process, especially following the outcry over several infractions of labour laws.

At the same time, the company continues to hold exclusive control over the production process of the plantations, while the "sub-lessor" or "subpartner" is contractually bound to produce and supply exclusively sugar cane for Cosan. Such contracts still allow Cosan to take direct possession of the area if the cane production or delivery is below the level it considers satisfactory.

## **WORKING CONDITIONS IN SUGAR CANE MONOCULTURE**

The model historically adopted by the sector was based on payment of cane cutters per amount of cane produced and not per hour. This has led to a structural, degrading situation for the workers. Flouting of labour laws therefore is not a matter of isolated incidents, but occur systematically in the sugar cane industry. In an effort to improve their image in public opinion, mainly in order to gain access to the external market, firms are taking steps to extend mechanised cane harvesting.

However, in regions where mechanised harvesting is the norm, like the state of Sao Paulo, labour conditions have deteriorated as the production quota the cutters have to meet to keep their job keeps increasing. In addition, firms use the mechanisation by way of blackmail to avoid cutters' demands for higher wages and better working conditions. This situation is physically exhausting and therefore structurally degrading. The reports of disease, accidents at work, cases of slave labour and even death by exhaustion, as noted before, are legion. Because payment is per amount produced, the worker sees himself forced to cut more and more to try to meet a quota increasing with mechanisation, given the risk of unemployment in the sector.

Several steps in the production of sugar cane have already been mechanised, thanks in a large part to subsidised loans from Proálcool. Thus, the number of workers needed for planting and crop treatment fell during the 1970s and 1980s. Mechanisation of harvesting cane by contrast only started to see significant increases from the start of the twenty-first century. One of the main effects of the harvest mechanisation was seen in the area of labour rights violation, including tens of cases of death, principally after the use of mechanised harvesters had become the norm.

Reports of workers abound about the way in which the work is carried out and about their degrading work conditions. In her study *Errantes do fim do século*, Maria Aparecida de Moraes Silva (1999) analyses the consequences of mechanisation of cane field ploughing in relation to working conditions. One of the strategies used by the owners of a mill to avoid cumbersome procedures to comply with labour laws is to maintain a system based on temporary contracts via intermediaries who provide the migrant workers constituting the main work force on the plantations. This middle man is an essential part of the strategy because his job is to bring the workers from their home towns to the mills.

This transport occurs in an improvised, often illegal, manner and workers end up with "debts" for the costs of transport, housing, food and other expenditures they are unable to pay from their salary and which mount once they have already left their home town. This means the workers already start out with debts when they arrive and this system is used to keep them in the cane harvest, even under degrading conditions or those amounting to slave labour.

The harvest system has remained basically unchanged since the 1960s, with payment depending on the number of tonnes cut, based on the metres of cane cut, and with the calculation of average weight per metre determined using the mill's scales. Silva<sup>24</sup> (1999, p.108) draws attention to the existence of a percentage of the worker's salary which goes to the middle man. But this direct interest of the middle man in the workers' productivity is not the only strategy employed by the firms to increase their profits. As the middle man is the one

24 SILVA, Maria Aparecida de Moraes - *Errantes do fim do século*. São Paulo, Editora UNESP, 1999.

employed by the cane producing company, the worker can not see the process whereby metres cut are converted into tonnes; thus, both the company and the middle man can in theory keep a portion of the production that should be paid out to the cutter. Furthermore, the companies use the middle man as their intermediary in the workers' register to avoid formal work contracts and escape responsibility for the disregard for workers' rights. This (compulsory) register grants workers labour rights and obliges employers to pay employee contributions. This situation is observed in various cases where Cosan does not respect these rights.

## **PRESSURE TO CHANGE WORKING CONDITIONS IN THE SUGAR CANE SECTOR**

Although many cutters now receive the necessary equipment from the company and have a formal work contract as a temporary (per harvest, with wages and benefits received at the end of the harvest) or permanent worker (benefits being received when they are dismissed), labour laws are still frequently broken, both in Sao Paulo and in other regions (Silva, 2008<sup>25</sup>). The main thing the firms are concerned about is their image, particularly in international public opinion.

An example of their strategy can be found in the "National Agreement to Improve Working Conditions of the Sugar-Cane Sector" (Compromisso Nacional para Aperfeiçoar as Condições de Trabalho na Cana-de-Açúcar)<sup>26</sup>, launched in June 2009. However, compliance with the Agreement and the way to evaluate it are still in the initial debating stages, two years after more than two hundred mills signed up. This type of agreement to improve working conditions therefore does not have any practical effect since there is no monitoring or appropriate punishment if the guidelines are not followed.

The Secretariat-General of the President of the Republic, the institution managing the agreement, has confirmed that at least 248 mills (out of more than 300 who showed an initial interest to sign up, in the middle of 2009) have registered. The only thing this register does is to grant firms, upon request, verification on site, as highlighted in the document: "Only those firms will be recognised that have actually been found to comply with the rules set out in the agreement by external auditors".

According to the report *O Etanol Brasileiro no Mundo – Os impactos Sócio-Ambientais Causados por Usinas Exportadoras* ("Brazilian Ethanol in the World – Socio-Economical Impacts Caused by exporting plants")<sup>27</sup>, "It is still unclear though, how this audit will be

25 SILVA, Maria Aparecida Moraes. Trabalho e trabalhadores na região do 'mar de cana e rio de álcool. *Migrantes*. São Carlos, EDUFSCAR, 2008.

26 The Agreement can be accessed, in Portuguese, and its signatories seen, on <http://www.secretariageral.gov.br/arquivos/publicacaoacanaeacucar.pdf>.

27 On: [http://www.reporterbrasil.org.br/documentos/Canafinal\\_2011.pdf](http://www.reporterbrasil.org.br/documentos/Canafinal_2011.pdf); May 2011, p. 6.

done. Neither are there any deadlines. (...) So much time has been taken up with dithering that the original deadline for the Commitment, June 2011, has passed with hardly anything concrete to show for it. Government employees and those with links to the government, determined to carry the initiative forward, simply wish to prolong the accomplishments of 2009”.

The Commitment is clearly not being complied with; rather, firms use it as a way to prolong the degrading working conditions. An example of this was the inclusion of the Cosan Group in the Ministry of Labour and Employment’s “dirty list” on 31 December 2009 due to its use of workers in conditions comparable to slavery. After this denunciation, Cosan signed an Agreement of Conduct Adjustment (TAC), allowing its name to be removed from the list. Signing such an agreement does not offer any guarantees with respect to improvement in working conditions by the company, but strikes it from the list, thus cleaning up its image in the eyes of the market.

## **EXPLOITATION OF SUGAR CANE WORKERS**

With the increasing use of mechanical harvesters, manual sugar cane cutting decreases with every harvest. An estimated 60% of planted area in Sao Paulo now uses mechanised harvesting. The number of cane cutters in this state fell by 8.8% between 2009 and 2010 and is currently around 140,400. Relative to 2007, the drop is of 21.1%, according to the research report *Ocupação Formal Sucoalcooleira em São Paulo* (“Formal Sugar Alcohol Employment in Sao Paulo”) by researchers of Sao Paulo State University (UNESP) in the city of Jaboticabal, Sao Paulo. The reason why the drop in manual cutting force was not bigger is because areas recently taken into production in the state have seen less mechanisation as both manual and mechanised harvesting are used<sup>28</sup>.

The continuing disregard for labour laws demonstrates once more that this problem was not solved with the process of mechanisation in the sector, but rather has moved to a different level and now coexists with cases of death on the plantations, (stemming from the demand for extremely high productivity) even though apparently, outsourcing and the presence of the middle man have diminished as these have been replaced with other, less obvious forms of outsourcing. The role of the middle man has been replaced by the contractor<sup>29</sup>. In other words, outsourcing practices continue, as do the exploitation of workers, constant salary cuts, payment per productivity, cheating at the calculations of payment when weighing the cane, and other infractions of workers’ rights.

28 See: [www.fcav.unesp.br/baccarin/Boletim%20ocupacao%20Cana%2021.doc](http://www.fcav.unesp.br/baccarin/Boletim%20ocupacao%20Cana%2021.doc)

29 It is worth noting that although the contractor’s salary is still linked to the worker’s productivity, which drives him to push these, he is not responsible for their payment, which reduces his power to manipulate. Manipulation is instead carried out by the plants.

When analysing the increase in productivity, we notice the exploitation of workers has actually increased<sup>30</sup>. The rise in productivity – from 3 tonnes per day in 1970, to 6 tonnes per day in 1990 – is connected to an increasingly strenuous competition between workers and labour substitution in the production process, driving the worker to cut ever more, receiving ever less per tonne of cane. Salaries are not only cut by paying less than was specified in the agreements between employers and trade unions (which also continues), which happens when both the middle man and the sugar cane company seize part of the wages; it is also a result from the agreements themselves in which both sides “agree” to ever lower payments per tonne of sugar cane. This situation becomes more pronounced with the increasing mechanisation of sugar cane cutting<sup>31</sup>. Whereas in 1970 a worker would receive the equivalent of R\$ 2.00 per tonne of cane cut, in 1990 this was R\$ 0.96 and in 2005 each tonne of cane would render R\$ 0.86.

The pressure placed on a worker to increase his productivity reveals a typical form of exploitation in the mills. Cutters who fail to reach the ever higher production targets, currently between 10 and 15 tonnes of cane per day, are not re-hired. The increasing use of mechanical harvesters leads to a steady increase in competition between the cutters and, as a result, to increased productivity of the workers. According to Dr Pedro Ramos, in 1977 the daily average was 3.77 tonnes; in 1985 the amount was 5 tonnes; in 1998, 7 tonnes, reaching 8 tonnes in 2005 (Ramos, 2007, p.16)<sup>32</sup>.

Reports of whole body cramping followed by death, due to excessive exertion at work (17 people died on sugar cane plantations in Sao Paulo in the harvests of 2004 to 2007) (Ramos, 2007, p.16), denounced by the Catholic support network ‘Serviço Pastoral do Migrante’ of Guariba<sup>33</sup>, and by the Social Network for Justice and Human Rights (Rede Social de Justiça e Direitos Humanos) (2009) have become frequent in sugar cane cutting, as have instances of illnesses and mutilations. It is therefore not due to the sector’s lack of progress that labour laws are violated, as this practise continues even with the predominant mechanisation of cane cutting.

30 Ramos, Pedro – “O Uso de mão-de-obra na lavoura canavieira: da legislação (agrária) do Estado Novo ao trabalho super-explorado na atualidade”. *Anais II Seminário de História do Açúcar: Trabalho População e Cotidiano*. Itu, SP, 11-15 November 2007. São Paulo, Editora do Museu Paulista da USP, 2007.

31 Adapted from: PITTA, Fábio T. – *Modernização retardatária e agroindústria sucroalcooleira paulista: o Proálcool como reprodução fictícia do capital em crise*. MSc thesis, Department of Geography, University of Sao Paulo, Faculty of Philosophy, Languages and Literature, and Human Sciences 2011.

32 Ramos, Pedro – “O Uso de mão-de-obra na lavoura canavieira: da legislação (agrária) do Estado Novo ao trabalho super-explorado na atualidade”. *Anais II Seminário de História do Açúcar: Trabalho População e Cotidiano*. Itu, SP, 11-15 November 2007. São Paulo, Editora do Museu Paulista da USP, 2007.

33 To follow denunciations of labour exploitation and cases of death on the plantations, visit the site of the Pastoral do Migrante network of Guariba: [www.pastoraldomigrante.org.br](http://www.pastoraldomigrante.org.br) and that of the Social Network for Justice and Human Rights: *Monopólio da Terra no Brasil: Impactos da expansão de monocultivos para a produção de agrocombustíveis*, [www.social.org.br](http://www.social.org.br).

Another contributing factor to the exploitation of workers is the high debt and default rate of the mills, which depend on public resources to survive. The supposed “competitiveness” of Brazilian ethanol on the foreign market therefore is based on the exploitation of labour, state subsidies and various forms of appropriating natural resources, such as the illegal seizing of land.

## **WOMEN WORKING IN THE PREPARATION OF PLANTATIONS**

Mechanisation is also on the march in the preparation of sugar cane plantations for the next production cycle. The progression of mechanised sugar cane planting is defended by the sector citing the possibility to shorten the minimum period needed to prepare plantations before the first planting or between harvests, as well as cost savings relating to the employment of labour force<sup>34</sup>. This process could be observed during field work in the north-western region of the state of Sao Paulo, in the period between harvests of a plantation to be used by Cosan group’s Gaza mill.



*Photo 1: Equipment used in mechanised sugar cane planting. Supplier farm of cane for Gaza plant (Cosan), in the municipality of Andradina (Sao Paulo state). Xavier, C.V. May 2011.*

Notwithstanding the rise of mechanised planting, currently becoming more prevalent in all cane growing regions of Brazil, manual planting continues to play an important role for the sector. This way, similar to the situation for cane cutting, the concurrent presence of the different forms of planting can be seen here too, against the backdrop of increasing exploitation.

During field work the overwhelming presence of women in the labour force for this work was noticed. The extensive use of female planters is depicted by the corporation as a necessary solution for the lack of male labour force available to carry out this work.

34 EMBRAPA (2011). Available on [http://www.agencia.cnptia.embrapa.br/gestor/cana-de-acucar/arvore/CONTAG01\\_74\\_22122006154841.html](http://www.agencia.cnptia.embrapa.br/gestor/cana-de-acucar/arvore/CONTAG01_74_22122006154841.html)

According to the women workers, the female labour force in this work is the result of the extremely low wages planters receive. At this Cosan mill, the women's work earns them a minimum daily wage of R\$19.00<sup>35</sup>. The women add that daily wages may reach up to R\$30.00, but for this they have to work much harder, which requires great physical effort. This way, a situation is created in which payment is based on the worker's productivity.

With regard to the working conditions imposed on the planters, it can be clearly seen that it is very difficult for these women to exceed the minimum daily wage, as even this fixed basic minimum is tied to a labour output regarded as the minimum production. The mills thus demand a physical effort that is continually increasing, as the work that needs to be carried out to receive this basic wage takes place in extremely arduous circumstances.

At the start of the day, each worker is assigned an area to be planted of approximately 750 m<sup>2</sup>. This area consists of what is referred to as 8 rows separated by alternating spaces of 90 and 150 cm. Each row is around 76 m in length. Planting an area this size corresponds to a sum of R\$9.00 in wages. Taking into consideration the fact that the average time to carry out this task is five hours per worker, it is clear that even the minimum productivity required for the daily wage is an extremely hard task. The process of manual planting is illustrated in photos 2 and 3.



**Photo 2:** Cane field being prepared for replanting. Note the machine forming the rows, interspaced by 90 and 150 cm. Area belonging to Mundial plant (Cosan). Xavier, C. V. May 2011.



**Photo 3:** Area prepared for replanting of cane, to be performed manually by female labour force. Area belonging to Mundial plant (Cosan). Xavier, C. V. May 2011.

<sup>35</sup> Based on information gathered during field work, daily wages at other plantations vary between R\$22,00 e R\$25,00 – for the same job. In areas where average wages tend to be higher, male work force is used for manual planting.

Apart from the great physical strain, extra tension is generated due to the nature of this way of working, which manifests itself in the relation between workers, all trying to achieve the highest possible production. The reasons cited most often for the eruption of this tension is of one worker allegedly straying into another's working area, which would affect the amount of work each has carried out that day. An environment of competition can therefore be seen, brought about by the efforts to maximise productivity, even if this negatively affects the workers' physical health.

Another contributing factor to the exploitation of the labour force is the advance of mechanised planting. In a similar fashion to that seen in cane cutting, mechanisation serves as yet another element leading to the deterioration of working conditions. The substitution of manual planting by mechanised planting forms a constant threat for the workers, who are inclined to accept the degrading conditions in an attempt to drive up their productivity.

## **MECHANISED HARVESTING BY COSAN-SHELL SUPPLIERS**

In keeping with the strategy Cosan-Shell have of outsourcing the entire cane production, one of the steps in the production process to receive a lot of attention is the combined process of harvest, transfer and transport, referred to by Cosan as cut-load-haul or its Portuguese abbreviation CTT. Since Cosan adopted this policy at the end of the 1990s, the increasing presence of companies specialised in these logistics services is noticeable. Some of the main firms in this respect are Expresso Nepomuceno Transporte e Logística, Julio Simões Logística, Aqces Logística and Arquitetura em Transportes.

With the different ways in which cane processed by Cosan is produced (on owned land, leased land, in partnership of by external suppliers), CTT is also outsourced. In case the contract prescribes the cane delivery take place on the field itself, the mill is responsible for the harvest, transfer and transport. In that case, the firm hired by the agro-processing unit is the service provider. If, on the other hand, the contract with the supplier specifies the delivery of sugar cane to the unit, it is the producer who is responsible for the harvest and delivery of the cane.

With respect to the product suppliers who are responsible for the CTT activities themselves, some organise themselves into so-called "condominiums" where different suppliers collaborate to carry out these steps. In this system the producers jointly carry out the hiring of all labour force needed, for areas of mechanised as well as manual harvesting. The condominiums are part of the suppliers' strategy to have available all machines specific for harvesting activities. By pooling resources, they are able to acquire equipment such as tractors, harvesters, loading equipment, lorries etc. Photo 4 shows the harvesting process performed by a condominium in the north-eastern region of Sao Paulo.



**Photo 4:** *Mechanised harvesting being carried out at cane supply field for the Gaza plant. The equipment, as well as the respective operators, are the responsibility of a “condominium” formed by various suppliers of the plant. Xavier, C. V. May 2011.*

As for manual labour employed in mechanised harvesting, the main characteristic is still the seasonality of the work, both for those working in the manual and those in the mechanised part of the production process. As with the other jobs, here too workers’ wages are based on productivity. There is a salary floor corresponding to the average productivity per worker and a supplement based on production exceeding this average. With workers’ pay regulated like this, working conditions can be seen to deteriorate.

In their striving for greater productivity, the operators of the machines submit to working days of more than 8 hours; working days of up to 12 hours are common. A contributing factor to this is insecurity on the part of the workers due to the cyclical nature of their jobs. Also worth noticing are recurring problems of low yields of the fields caused by inadequate execution of the mechanised harvesting. When such problems occur, harvest operators are held responsible, which creates a tense atmosphere among the workers. These problems are usually related to matters such as:

- Damaging of the field due to the moving of the machines over production areas. This tends to reduce yields of the field in the next harvests.
- Poor cutting of the stalks. Ideally, with mechanised cutting, the stalks are cut at an average of 10 cm from the ground, in order to avoid issues like high levels of mineral impurities. If the cut is very low, yields of harvested cane will decrease because of the low saccharose concentration.

These are some of the factors leading to constant stress for the workers, be it because of the long hours, a constant striving to increase productivity or the risk of errors in mechanised harvesting that compromise the execution of the task.

## SLAVE LABOUR IN THE SUGAR INDUSTRY

According to the Pastoral Land Commission (CPT), a Catholic agency that tracks rural violence in Brazil, and the Brazilian Ministry of Labour and Employment, more than 10,000 workers were rescued from conditions comparable to slavery on Brazilian plantations between 2003 and 2010. The worsening of working conditions in the sugar cane sector can be seen in the following table:

### Number of workers in situations comparable to slavery<sup>36</sup>

Year	Lines of business with the most workers rescued (total and %)		
	First place	Second place	Third place
2007	Sugar cane (3,060; 51%)	Cattle farming (1,430; 24%)	Other and not indicated (538; 9%)
2008	Sugar cane (2,553; 48%)	Cattle farming (1,029; 20%)	Other agriculture (731; 14%)
2009	Sugar cane (1,911; 45%)	Other agriculture (804; 19%)	Cattle farming (603; 14%)
2010	Other agriculture (1,014; 33%)	Cattle farming (784; 26%)	Sugar cane (535; 18%)
2003 – 2006	Cattle farming (6,510; 40%)	Other agriculture (3,415; 21%)	Sugar cane (1,605; 10%)
2003 – 2010	Cattle farming (10,357; 30%)	Sugar cane (10,010; 29%)	Other agriculture (6,359; 18%)

From 2003 to 2006, the sugar cane sector was responsible for 10% of total cases of slave labour (1,605 cases). In 2007, 2008 and 2009, sugar mills were leading the statistics of freed slaves. In 2007, 51% of rescued people (3,060) were working in the sugar cane sector; in 2008, this was 48% or 2,553 people; and in 2009, the number was 1,911 (45%). In 2010, the sector saw the liberation of 535 workers (18% of the total).

The number of over 10,000 workers rescued by inspection organs of the Labour Ministry is equivalent to that of the cattle farming sector. From 2003 to 2010, 10,357 people were rescued from firms connected to cattle breeding. This makes cattle farming and sugar cane together responsible for almost 60% of all liberations in Brazil in the last eight years.

36 *O Etanol Brasileiro no Mundo – Os impactos Sócio-Ambientais Causados por Usinas Exportadoras*.  
 On [http://www.reporterbrasil.org.br/documentos/Canafinal\\_2011.pdf](http://www.reporterbrasil.org.br/documentos/Canafinal_2011.pdf); May 2011, p. 5.

## **VIOLATIONS OF LABOUR LAWS BY COSAN**

On 31<sup>st</sup> March 2010, Cosan had 41 thousand employees. Of these, some 27 thousand were seasonal workers. More than 33 thousand were working in sugar cane production, mostly in harvesting.

The company was put on the Ministry of Labour's "dirty list" on 31st December 2009. During an inspection in June 2007, 42 people were freed who were working in conditions comparable to slavery in the Junqueira mill in Igarapava, Sao Paulo state. Immediately after it was added to the list, the company's lawyers made an agreement with the government and on 8th January 2010, after signing an Agreement of Conduct Adjustment (TAC), the company was removed from the list via a temporary injunction.

Cosan's labour issues are not limited to the practice of slave labour<sup>37</sup>. During inspections carried out in 2008 by the Ministry of Labour and Employment and by Mario Antônio Gomes, public prosecutor in Sao Paulo, irregularities were encountered on 18 of Cosan's plants. The prosecutor found a "lack of drinking water at the work place, lack of personal protective equipment, lack of appropriate places to consume food, absence of toilets on the land, among other things". Other cases of irregularities are:

- In 2010, the company was forced to sign two agreements with the Labour prosecutor's office (public prosecutor's office) of the city of Campinas: one for the sum of R\$ 2.5 million and the other for R\$ 900,000 concerning labour problems as well as the violation of previous Agreements of Conduct Adjustment.

- In July 2010 one of Cosan's suppliers in Santa Cruz do Rio Pardo in Sao Paulo state was caught by the Labour prosecutor's office with workers in degrading conditions, with salaries in arrears and with no drinking water in the workplace.

- During the 2008 harvest, workers at the Diamante mill had already gone on strike, demanding better working conditions. In 2009, six workers were found who had no formal contract, no record of the hours worked, no days off on Sundays and public holidays and who were cutting cane in seven, instead of five, rows.

- In 2009, Cosan's Diamante mill in the region of Jaú (Sao Paulo state) was reported on 22 accounts of misconduct by the Rural Inspection Group of the Labour Ministry. The inspection involved 2,628 workers, of whom 464 women, and the offences were absence of formal work contracts (6 workers), general lack of adhering to working hours, failure to comply with weekly rest days on Sundays and public holidays, cutting of seven rows instead of five, unhygienic bathrooms, occupational health certificates and the environmental risk prevention programme (PPRA) lacking risk assessments for workers, lack of incident response

<sup>37</sup> The cases presented by Cosan have been compiled from the reports (in Portuguese) *O Etanol Brasileiro no Mundo – Os impactos Sócio-Ambientais Causados por Usinas Exportadoras*. On: [http://www.reporterbrasil.org.br/documentos/Canafinal\\_2011.pdf](http://www.reporterbrasil.org.br/documentos/Canafinal_2011.pdf); May 2011.

plans, irregularities with respect to housing, third companies providing transport and a lack of toilet and eating facilities.

- During the 2007 and 2008 harvests, workers at the Gaza mill in Andradina, Sao Paulo state, went on strike, demanding better working conditions. The trade union said strikers were dismissed afterwards, in violation of the constitutionally guaranteed right to strike.

- In 2009, workers of the Da Barra unit were found without a formal contract, including no record of their starting and leaving dates / times, work being carried out on Sundays, absence of work permits, irregularities in personal protective equipment and dirty bathrooms.

- Benálcool plant: in June 2010, Cosan was made to pay R\$ 26,100 in fines for breaching the TAC. Workers were forced to work Sundays and public holidays.

- Univalem plant: in July 2010, Cosan was fined R\$ 2,500 for failure to comply with two clauses of the TAC signed in 2007. This failure occurred in the Valparaíso unit. The company was required to grant workers 11 hours off between two working days and to remain within the legal limits of a normal working day. Meanwhile, according to inspectors, 65 employees were found working outside normal working days. These irregularities are reported annually since 2005; hence the failure to comply with the TAC.

- Serra plant: in 2009, Cosan was made to pay R\$ 200,000 for irregularities in working conditions in the city of Ibaté (Sao Paulo state).

- Mundial plant: in July 2008, via the Rural Workers' Trade Union of Andradina, 53 employees were found to be employed through middle men to carry out sugar cane planting of about 39 hectares in the municipality of Murutinga do Sul (Sao Paulo state). The workers had no formal contract or personal protective equipment. The area had originally been leased by Cosan; the company then signed a contract to outsource cane production. This third party then contracted its own middle men to recruit the workers. This way, work was in fact outsourced twice and workers found themselves depending on a "turmeiro", or labour contractor, whom even the workers themselves could not name at the time of inspection.

- In March 2010, the Labour Ministry received reports denouncing irregularities at three cane production farms for Cosan (Gaza plant). Farmers at these farms leased their land to the Cosan group or granted them in partnership for sugar cane planting; Cosan in turn had sublet them or entered into sub-partnerships with unknown third parties. A total of 350 workers were employed in manual planting or cutting with their employers failing to provide them with personal protective equipment, adequate tools, access to basic medical care and first aid, and with dangerous or inadequate means of transport, sanitary facilities and drinking water. Another problem that was observed was associated with the long hours worked, a result of the drive to increase productivity.

## OCCUPATION OF INDIGENOUS LANDS

While ethanol firms paint a picture of Brazil as the world's "ethanol barn" with large areas of land "available", there is mounting violence against farming communities and indigenous people. In the state of Mato Grosso do Sul, where Raízen is active, the Guarani-Kaiowá have been driven away from their territory and pushed into a small area. The Federal Public Prosecutor estimates there are as many as 47,000 Guarani-Kaiowá in Mato Grosso do Sul, the largest population of indigenous people in Brazil, living in an area of about 20,000 hectares.

The expansion of cane monoculture aggravates the state's land problem. According to the Indigenous Missionary Council (CIMI), the Guarani-Kaiowá live in extremely difficult circumstances; lack of land leads to serious social problems such as child death due to poor nutrition, suicides (especially among young people between 12 and 18 years old), alcoholism and killings. These peoples have long been the subject of violence by large land owners, with cases of murders as well as slave labour in cane cutting. According to the CIMI's report, four murders of indigenous people have been documented in the housing facilities of mills.

The rural sector puts pressure on the government against the demarcation of indigenous lands, exacerbating the situation of conflict in the state. The state government even intends to amend the law to allow new mills to be built in the Pantanal nature reserve, in the region between the river basins of the Paraguay and the Paraná. This project may intensify land conflicts even further, while also causing more destruction to the Cerrado and contaminating rivers and subterranean water reservoirs, including the Guarani Aquifer. According to Alessandro Menezes, of the organisation *Ecologia e Ação*, "Sugar cane monoculture has the potential to change large areas of the Cerrado, thereby compromising biodiversity and distorting the area surrounding the Pantanal, a Unesco World Heritage Site"<sup>38</sup>.

In June 2008, the Legislative Assembly of Mato Grosso do Sul state approved a law ending the requirement for a minimum distance of 25 km between mills. This means sugar cane monoculture could occupy 70% of the south of the state; it will also allow the installation of an alcohol pipeline to transport ethanol to the port of Paranaguá.<sup>39</sup>

The effects on the climate, such as drought in the region, can already be seen. The mills, breaching environmental legislation, practice sugar cane burning. An article in the magazine *Dourados Agora* comments: "The large scale pollution is already visible in several areas of the municipality and the low relative humidity of the air is already beginning to get security organisations worried about the risk of respiratory diseases. The Institute for the Environment (IMAM) is starting to look into the reports"<sup>40</sup>.

38 Instituto Sócio Ambiental, *Governo do Mato Grosso do Sul quer liberar usinas perto do Pantanal*, 15/07/08, <http://www.brasiloeste.com.br/noticia/1623/usinas-pantanal>

39 Midiamax, *Incentivo à cana acaba com produção de grãos*, 26/6/2008, <http://www.portalmms.com.br/noticias/Ecoa-incentivo-a-cana-acaba-com-producao-de-graos/Mato-Grosso-do-Sul/Meio-Ambiente/16525.html>

40 *Dourados Agora*, *Mesmo proibidas, começam queimadas de cana em Dourados*, 07/07/2008 18:34.

In the municipality of Caarapó, in Mato Grosso do Sul, Raízen controls the Nova América mill, leased from the Santa Claudina farm owned by state representative José Teixeira, which trespasses onto the Guyraroca indigenous land. The area has already been visited by Brazil's national organisation for Indigenous people Funai and a summary of the identification and description was published in the Federal Official Gazette *Diário Oficial*. A technical note of the Federal public prosecutor confirms that the farming activities on the Guyraroca territory has caused accelerated environmental degradation, particularly to the riparian forest around streams and rivers. This degradation is a contributing factor to the drying up and silting of mines and river courses.

## **ENVIRONMENTAL DEGRADATION IN AREAS OF SUGAR CANE EXPANSION**

On a global level, fervent discussions are taking place about the development of so-called "alternative" energy sources. This is where foreign companies like Shell come in, looking to increase the international ethanol market and to improve their own image and reinforcing the propaganda about the alleged environmental benefits of biofuels compared to fossil energy sources. Themes such as "renewable" energy sources and environmental "sustainability" have come to dominate discussions on the agro-energy capital, showing themselves useful terms for the promotion of biofuels as "clean energy sources". In Brazil, the notion that ethanol would be a "renewable" energy source is used to legitimise cane monoculture with dire environmental consequences. To show the other side of the story, a closer look is needed, from a critical perspective, at the environmental and social impact of the way in which ethanol is currently produced.

## **THE USE OF SUGAR CANE BURNING AND THE RISE OF MECHANISED CUTTING IN SUGAR CANE REGIONS**

The first relevant point is the recurrent use of sugar cane burning for cane harvesting. Particularly in traditional cane producing regions like for example Piracicaba, Ribeirão Preto and Araraquara, all in the state of Sao Paulo, burning continues routinely to be seen.

Companies defend the practice citing reasons of efficiency and economy during cane cleaning, economical advantages during processing, increased yield of manual cutting and a decrease in the number of incidents involving poisonous animals that can often be found on the plantations. On the flip side, burning has a great impact on the equilibrium of flora and fauna; it is one of the causes of declining air quality in the cities, the development of acid rain, which in turn has a direct influences on the availability of nutrients in the soil; the ashes also ultimately end up blocking the pores in the top layer of the soil, leading to the formation of a thin crust that reduces water infiltration and decreases aeration<sup>41</sup>.

41 Mialhe, L.G. Máquinas agrícolas: ensaios & certificação. Piracicaba: Fundação de Estudos Agrários Luiz de Queiroz, 1996. 722p. Chapter 10

When listing these issues, it is clear that this process carries the risk both of altering local environmental characteristics and of causing harmful effects for the health of the population in these regions<sup>42</sup>. According to Brazil's National Institute for Space Research INPE, during periods of burning, which coincide with the dry season, it tends to be necessary to declare a state of emergency as relative humidity of the air reaches extremely low levels of between 13% and 15%, constituting a public health problem<sup>43</sup>.

Although burning is widely practised in sugar cane production, it cannot be denied that currently, in the context of the recent expansion phase of sugar cane culture, pressure is mounting to reduce this practice. An important sign of this reduction can be found in the state of Sao Paulo, Brazil's largest cane producer, responsible for around 61% of the country's total cane production. Of the state's 2010-2011 harvest, around 60% of all cane cut is expected to take place without burning, that is, using mechanised harvesting, illustrated in photos 5 and 6.



**Photo 5:** Mechanised cutting of unburnt sugar cane in the region of Andradina, Sao Paulo state – region of current cane culture expansion. Xavier, C. V. May 2011.



**Photo 6:** Machine used for mechanised cutting of unburnt cane. Region of Andradina, Sao Paulo. Xavier, C. V. May 2011.

42 Aebex, M. A. Avaliação dos efeitos do material particulado proveniente da queima da plantação de cana-de-açúcar sobre a morbidade respiratória na população de Araraquara – SP. 2002. PhD Thesis (Pathology) – Faculty of Medicine, University of Sao Paulo, Sao Paulo.

Ribeiro, H. Queimadas de cana-de-açúcar no Brasil: efeitos à saúde respiratória. Revista de Saúde Pública da USP. Sao Paulo, 2008. 7p.

43 Plácido Junior; Melo, M.; Mendonça, M. L. *O mito dos agrocombustíveis*. Pastoral Land Commission and Social Network for Justice and Human Rights. *Agroenergia: mitos e impactos na América Latina*. Sao Paulo, July 2008. [www.social.org.br](http://www.social.org.br)

The main consequences of the practice of mechanical harvesting concern the increasing unemployment among sugar cane cutters. The principal arguments in favour of mechanised harvesting focus on environmental aspects via the reduction of problems caused by cane burning, in particular its contribution to a reduction in the emission of harmful gasses into the atmosphere. In spite of the firms' talk about "environmental responsibility", even in mechanised harvesting there are cases where cane burning continues.

The reduction in burning occurs largely due to two apparently opposite mechanisms but which have both led to a rise in mechanical harvesting. On the one hand, there are the denunciations of social organisations that have resulted in pressure to mitigate environmental damage; on the other, those that have resulted in labour demands for the sugar-alcohol sector. Together, this has led to the implementation of environmental laws such as State Law 11.241/02 of Sao Paulo, which stipulates the gradual elimination of the practice of burning of sugar cane straw. In addition, it has led to demands for the improvement of living and working conditions of workers employed in manual harvesting, which are part of the denunciations of increased exploitation of workers, concentrating mainly on raising the average wage for workers<sup>44</sup>. Rather than attend to demands for better working conditions, companies have opted for mechanisation, as low pay and degrading working conditions are essential for the sector's alleged economic "competitiveness".

With mechanised harvesting on the increase, sugar-alcohol producers are looking to highlight their "social and environmental responsibility" to the international market to clear the industry of accusations concerning negative environmental effects and labour rights. In other periods of monoculture expansion, like the 1980s, an increase in harvest mechanisation can be observed, a consequence of the employers' reprisal for the harvesters' strike that started in the area of Ribeirão Preto in 1984. During the 1990s, and especially after Rio 92, the United Nations Conference on Environment and Development, the subject of mechanisation received renewed interest in the context of environmental demands from different sectors of society. From that point on, mechanised harvesting has been presented as the only alternative to sugar cane burning<sup>45</sup>.

This environmental argument to justify mechanised harvesting is questionable in view of the constant denunciations of burnt cane in areas with mechanical harvesting. The mills claim that this measure is only adopted in case of accidental fires. These accidents are usually caused by electrical discharge from lightning or nearby power cables, or by acts of arson. It is unlikely these are the causes of the fires as burnings continue to be frequent in mechanised harvesting.

44 Alves, F. Por que morrem os cortadores de cana? *Saúde e Sociedade*, Sao Paulo, v. 15, nº 3, p. 90-98, 2006.

45 Alves, F. Mecanização do Corte de Cana Crua e Políticas Públicas Compensatórias: indo direto ao ponto. *Ruris*, Campinas, v. 03, n. 01, p. 37-50, March 2009.

Information from the companies themselves show that harvesting yields after burning, either performed manually or by machine, are higher than those without burning. This fact is related to both increased productivity of harvesting in terms of tonnes / hour cut and to economical factors during processing, since approximately 50% of water content of the stalks is removed, resulting in a higher saccharose content. Other advantages become apparent when the cane is transported from the field to the mill, since burnt cane is free of straw and has a lower water content, which translates into lower transport costs.

## THE MYTH OF "CLEAN ENERGY"

The sugar industry uses environmental arguments to their advantage, arguing that ethanol presents a "renewable energy source" However, when the production chain is analysed, it becomes clear that this production system does in fact cause environmental degradation. One element is the large water consumption of the process: even without counting culture requirements, during processing itself 12 litres of water are needed for every litre of ethanol<sup>46</sup>.

Another misconception is the assumption that biofuels are carbon neutral. This alleged renewability, often cited by producing companies, is questioned in an article<sup>47</sup> by geneticist and biochemist Mae-Wan Ho, until retirement reader at the Open University (United Kingdom). Dr Ho explains that burning a biofuel results in the release into the atmosphere of the carbon dioxide the plants absorbed during growth. In the argument for renewability, CO<sub>2</sub> emissions from the production process are ignored; this includes chemicals and industrial material used in cutting, harvesting, transport, processing and refining, as well as the infrastructure used for the logistics and distribution of the product<sup>48</sup>.

Another important point is the large amount of vinasse that is produced during the distillation process. For every litre of ethanol produced, 10 to 18 litres of this compound are generated; the amount varies according to the technology employed during processing. Vinasse

46 Plácido Junior; Melo, M.; Mendonça, M. L. O mito dos agrocombustíveis. Pastoral Land Commission and Social Network for Justice and Human Rights. *Agroenergia: mitos e impactos na América Latina*. Sao Paulo, July 2007.

47 Mae-Wan Ho. Biofuels: Biodevastation, Hunger & False Carbon Credits. 11 December 2006. Press release from the Institute of Science in Society. Available on <<http://www.i-sis.org.uk/BiofuelsBiodevastationHunger.php>>. Accessed on 10 May 2011.

48 In a further rebuttal of this argument, which wrongly points to the carbon neutrality of the production process of ethanol, the next section will address the question of CO<sub>2</sub> release in consequence of techniques employed in sugar cane monoculture, with a focus on limestone application and the use of vinasse for fertirrigation.

has been finding widespread use in agriculture due to the great fertilising capacity it is said to possess, in spite of its serious pollution effects<sup>49</sup>.

The degree of pollution caused by vinasse is up to 100 times greater than that of domestic sewerage; this can be explained by the large amount of organic matter, its low pH, high corrosiveness and high biochemical oxygen demand (BOD) index. In addition to this, vinasse coming from the distilleries has a high temperature, reaching between 70 and 80°C. When released directly onto the ground, this is highly detrimental to the fauna, flora, microfauna and microflora present in the soil and water<sup>50</sup>.

Furthermore, when used in large quantities it contaminates surface and ground water, thus compromising not only human and animal health, but also the development of crops in the medium and long term<sup>51</sup>. This by-product of ethanol production, then, causes environmental damage as it is in part used as fertiliser on the fields and in part released directly on the ground as shown in photos 7, 8 and 9, below.



**Photo 7:** Area for the cooling and storage of effluent (vinasse). Installation owned by Mundial plant (Cosan), in the municipality of Mirandópolis (Sao Paulo). Xavier, C. V. May 2011.



**Photo 8:** Supply terminal of vinasse to be applied to cane monoculture land. Ipê plant, municipality of Nova Independência, in the region of Andradina. Xavier, C. V. February 2009.

49 Silva, M. A. S. da; Griebeler, N. P.; Borges, L. C. *Uso de vinhaça e impactos nas propriedades do solo e lençol freático*. In: Revista Brasileira de Engenharia Agrícola e Ambiental. Campina Grande: n.1, v.11, p.108-114, 2007.

50 Freire, W. J.; Cortez, L. A. B. *Vinhaça de cana-de-açúcar*. Guaíba: Editora Agropecuária, 2000, 203 p.

51 Stevenson, F. J. Cycles of sil-carbon, nitrogen, phosphorus, sulfur, micronutrientes. In: Tan, K. H. (Ed.). *Principles of soil chemistry*. 2<sup>nd</sup> ed. New York: Marcell Dekker, 1986, 362p.



**Photo 9:** Equipment used to apply vinasse to the soil. Cane land owned by Gaza mill (Cosan), in the region of Andradina (Sao Paulo). Xavier, C. V. May 2011.

## EXAMINING THE RENEWABILITY IN THE PROCESS OF CANE CULTURE EXPANSION

The direct damage from the use of vinasse as a fertiliser also has further environmental effects, such as acidification of the soil and increased release of carbon dioxide ( $\text{CO}_2$ ) into the atmosphere through the increased use of liming, the process of applying limestone to the soil. In most parts of Brazil, the soil is of a predominantly acid nature, that is, it has a low pH<sup>52</sup>. Most Brazilian soils therefore require treatment to improve the soil for the profitable growth of any crop, similar to that of sugar cane monoculture.

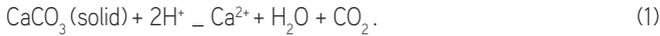
Therefore, for the necessary soil improvement, a widely adopted practice is liming of acid soil. In this practice, alkaline substances are applied to the soil, like mineral forms of calcium, magnesium or both, calcium oxide ( $\text{CaO}$ , also known as quicklime or burnt lime), calcium hydroxide ( $\text{Ca(OH)}_2$ , slaked lime), calcitic limestone and others. Of the above substances, treatment with calcium carbonate, magnesium carbonate or both is most widely used. Calcium sulphate is another widely used treatment, used to replenish lost sulphur via the leaching (draining out) of sulphate anions<sup>53</sup>.

Liming aims to increase the pH and decrease the acidity of the soil, decrease the exchangeable aluminium content and replenish calcium and magnesium, which tend to drain out. Leaching of these elements (calcium and magnesium) is triggered by different conditions, such as high acidity of the soil, competition with potassium and sodium for available cations, reduced adsorption capacity for these elements by clay in the soil, precipitation in the presence of certain anions, their low concentration in organic matter in the soil or a combination of these factors.

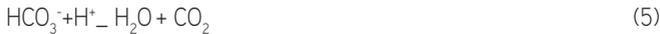
52 Mello, F.A.F. et al. *Fertilidade do Solo*. Escola Superior de Agricultura Luiz de Queirós da Universidade de São Paulo, Piracicaba, SP. Sao Paulo: Nobel, 3<sup>rd</sup> edition, 2<sup>nd</sup> reprint, 1988.

53 Mello, F.A.F. et al. *Fertilidade do Solo*. Escola Superior de Agricultura Luiz de Queirós da Universidade de São Paulo, Piracicaba, SP. Sao Paulo: Nobel, 3<sup>rd</sup> edition, 2<sup>nd</sup> reprint, 1988.

One physicochemical feature however is triggered together with the liming procedure that strengthens the argument against the alleged renewability of ethanol. The carbonates used in liming contain fixed carbon from the lithosphere, where this element is most prevalent. The different chemical reactions of these carbonates with the hydrogen ions responsible for the acidity of the soil all have as one of the end products carbon dioxide (CO<sub>2</sub>), which is released into the atmosphere. These processes can be represented using the following chemical equations, given that calcium carbonate when added to acidic soil can react in the following ways:



The anions CO<sub>3</sub><sup>2-</sup>, OH<sup>-</sup> and HCO<sub>3</sub><sup>-</sup> react with hydrogen ions in the soil in the following way:



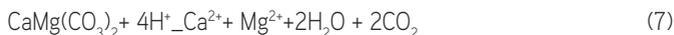
As can be seen from the above equations, the initial state contains calcium carbonate in the form of mineralised carbon (CaCO<sub>3</sub>) and in the end situation carbon is released into the atmosphere in the form of carbon dioxide gas (CO<sub>2</sub>). The reaction in equation 4 produces only water, but this reaction is part of the initial ion dissociation reaction of calcium carbonate in watery medium. In other words, this is an intermediary reaction in the process of reducing the acidity, which will result in the release of carbon dioxide as the end product. In a process with 100% reaction efficiency, this would lead to the release of 44 g of carbon dioxide for every mole (equivalent to 100 g) of calcium carbonate used; this corresponds to a release of 44% of the initial carbonate mass.

If we consider soil with a pH of 5, a cation-exchange capacity of 20 mg equivalent for every 100g soil, 65% base saturation and we know that at pH 6.5, its base saturation is 90%, this gives us a 13 mg equivalent of bases for every 100 g of soil at pH 5, and an 18 mg equivalent of bases for every 100 g soil at pH 6.5. This means that a 5 e.mg Ca<sup>2+</sup>/100 g soil must be added<sup>54</sup> to raise the pH from its initial value of 5 to 6.5. This is equivalent to 7.5 tonnes/ha of pure CaCO<sub>3</sub> for soil with an apparent specific mass of 1.5 g/cm<sup>3</sup> and an application depth of the soil improving agent of 20 cm. Of these 7.5 tonnes of limestone, by the end of the process of soil improvement, approximately 3.3 tonnes / ha of carbon dioxide (CO<sub>2</sub>) will be released into the atmosphere.

<sup>54</sup> e.mg = milligram equivalent

It should be pointed out that the limestone used, in general, is calcite. Because this is not pure  $\text{CaCO}_3$ , a higher amount than the 7.5 tonnes/ha calculated above will need to be added. This means that the model presented above with respect to the total greenhouse gas released in this process, is a theoretical approximation, underestimating the total amount of  $\text{CO}_2$  gas produced.

Dolomite, essentially formed of calcium magnesium carbonate,  $\text{CaMg}(\text{CO}_3)_2$ , may also be used to decrease soil acidity. At the same time, it is also used to supplement depleted calcium and magnesium. The molecular mass of  $\text{CaMg}(\text{CO}_3)_2$  is 184 g/mole and its reaction with  $\text{H}^+$  cations can be represented as follows:



Equation 7 shows that the 184 g/mole  $\text{CaMg}(\text{CO}_3)_2$  gives rise to a release of 88 g of  $\text{CO}_2$ , the equivalent of approximately 47.83% of the initial mass of used carbonate. Again, mineralised carbon from the lithosphere is transferred to the atmosphere in gaseous form, which clearly contributes to the greenhouse effect. Using a calculation analogous to that for calcitic limestone, we get a quantity of 7.5 tonnes / ha of pure dolomitic limestone to correct soil acidity. This amount releases some 3.6 tonnes / ha of carbon dioxide ( $\text{CO}_2$ ) into the atmosphere, considering only its use for soil improvement. Obviously, if the pH is below 5.0, larger amounts of limestone will be needed to reach a pH of 6.5, which is considered acceptable – which will of course result in the release of more  $\text{CO}_2$  into the atmosphere.

For the current system of cane monoculture, often on somewhat acid soil, vinasse is used for fertirrigation. Considering that the vinasse, from any source, has a low pH itself, applying it to the soil for sugar cane culture can, in contrast to its advertised fertilising properties, in fact contribute to an increased acidity of its surroundings. The exact features of this process of acidification of the soil depend of course on the relative pH values of the soil as well as the pH of the vinasse to be used.

Thus, by using vinasse on land that already presents high soil acidity, the result could be soil with a pH value even lower than 5.0<sup>55</sup>. From this it follows that a standard requirement for cane production is a procedure to improve the soil, in other words, increased liming is needed. On photos 10 and 11, below, the preparation can be seen of an area where soil improvement through liming is needed. Next, the application of limestone to the soil can be seen.

<sup>55</sup> Note that these calculations refer to soil improvement for base saturation because this method has the soundest theoretical base and is widely used in the state of Sao Paulo.



**Photo 10:** Limestone to be applied to an area where sugar cane is shortly to be planted. Plantation located in the region of Andradina (Sao Paulo). Xavier, C. V. May 2011.



**Photo 11:** Plantation during liming process. Located in the municipality of Andradina. Xavier, C.V. February 2009.

Another physicochemical feature associated with the composition of the vinasse concerns the potassium found in large quantities in the different types of the residue. Excess potassium may result in increased  $\text{CO}_2$  release into the atmosphere. A few of its effects are an alteration in the cation-exchange capacity and flocculation behaviour of the clay, which decreases the soil's buffering effect and its capacity to adsorb various ions which may otherwise drain out, particularly calcium and magnesium. Supplementing these elements, as described earlier, requires the addition of dolomitic calcium, resulting in the release of large amounts of  $\text{CO}_2$  at the end of the process.

Finally, soil low in organic matter has a reduced buffering capacity, among other problems. This is a physicochemical quality relating to the capacity of a certain soil to resist large variations in pH. Over time, continuous addition of organic matter to the soil has a buffering effect due to the processes carried out by microorganisms producing humus in the absence of large amounts of additional limestone.

However, in the current expansion practice, large quantities of these ores are used, suggesting that the organic matter present in the vinasse cannot be utilised by the microorganisms in the soil, probably because this exists of organic compounds pertaining to the category

of long-chain carbohydrates. This is highly probable looking at the low boiling point and heat resistance of various nitrogenated organic compounds, for instance sulphurated compounds<sup>56</sup>.

According to analyses of standard production conditions, sugar cane distillation is carried out at high temperatures, given that the vinasse is separated from the alcohol at temperatures around 80°C and that the boiling point of water is 100°C in ambient conditions (1 atm). At these high temperatures, only thermotolerant microorganisms survive, among which some pathogenic ones<sup>57</sup>.

The increasing production of sugar for energy results in higher amounts of vinasse to be used on the land, using the argument of vinasse as a “fertilising agent”. Monoculture expansion requires more limestone to improve the soil. The direct impact of this is that more carbon from the lithosphere is released in gaseous form (CO<sub>2</sub>) into the atmosphere. It is therefore vital to unmask the alleged environmental advantages trumpeted by the sugar cane industry.

## CONCLUSION

In this study about the merger between Cosan and Shell, an overview is given of the recent trends in the sugar cane sector and the role of ethanol production in Brazil is analysed. The formation of Raízen illustrates the growing trend of monopoly formation in the sector, mainly with participation of oil companies. Besides Shell, BP (British Petroleum) and Petrobrás now also control a significant portion of Brazil’s biofuel production.

The highest concentration of producers is associated with a rise in territorial expansion of sugar cane monoculture, particularly in areas with good infrastructure like the south-eastern region of the country, and in regions with large river basins like the Cerrado. This trend shows that the alleged “competitiveness” of Brazilian ethanol on the foreign market is based on the need for greater appropriation of natural resources, such as land and water.

The pressure from the ruralist wing in Brazil’s National Congress to change the forest code, the main law protecting the rainforest, illustrates this situation. The much-hyped “efficiency” of the sector therefore does not stand up, in that a fall in productivity levels is seen while at the same time agribusiness sector faces mounting pressure to move into environmental conservation areas. Land for cane monoculture expansion is acquired via the leasing of land, that is, by the displacement of food crop production, or by moving the agricultural frontier.

56 The organic compounds mentioned are the constituents of proteins, sugars, DNA, amino acids, alcohols, fatty acids, fats etc.

57 The points set out in this discussion could be made thanks to conversations with Prof. Dr. Sidneide Manfredini, Faculty of Philosophy, Languages and Literature, and Human Sciences, University of Sao Paulo, in Sao Paulo, 4 May 2011.

This process is connected to the international economic crisis and to a system in which investors create a speculative bubble causing a high increase in land and food prices.

The discussion about the “modernisation” of ethanol production also serves to hide a rising labour exploitation. As we have seen in this study, it is not due to the sector’s lack of progress that labour laws are violated. On the contrary, we have seen that exploitation of workers is worse in areas where mechanisation is the norm. In other words, this production model is intrinsically based on labour exploitation, allowing us to reveal another myth about the alleged “efficiency and competitiveness” of Brazilian ethanol.

It is also important to note the high debt and default rate of the sugar industry, corroborated by the sector’s dependence on loans at subsidised interest rates provided by Brazil’s government-owned development bank BNDES. Year after year, the mills request for debts from state banks to be pardoned or rolled over, in addition to various forms of subsidies and fiscal incentives.

All this leads us to conclude that the real “product” of this sector is not sugar cane, sugar or ethanol, but rather an immense financial, social and environmental debt. This insight helps us explain how the mechanisms of labour exploitation are maintained and how an agricultural model based on monoculture and large land ownership, in constant need to expand and seize more natural resources, continues to exist. Therefore, only a thorough shake up of this model could overcome the simultaneous crises in the economic, social and environmental spheres.



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Milieudefensie, has been campaigning on corporate social responsibility issues related to Royal Dutch Shell activities since the 1990's. In our 'Erratum' to the 2010 Shell Annual Report, corporate social responsibility-issues including those related to sugarcane production have been documented.

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